A COLLECTION OF FIELD EXPERIENCE GUIDE SHEETS

FOR HIGH SCHOOL SCIENCE TEACHERS

By

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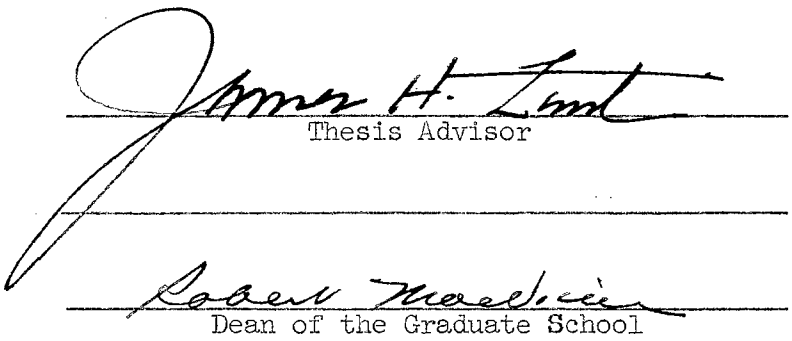

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TABLE OF CONTENTS

CHAPTER I

STATEMENT OF PROBLEM

The problem of this report is to present a collection of selected field experiences in the form of guide sheets. The guide sheets are designed for teacher and student use. The field experience guide sheets represent a sample of source materials that may be used as teaching aids for activities outside the classroom.

The term field experience has been used to mean an activity that takes place outside the classroom using a real situation in which the students participate or observe at first hand. The field experiences are for the out-of-doors. The field experiences described in this report are primarily limited to the study of living plants and animals, therefore are of a biological science nature in contrast to physical science nature.

Procedures in development of the field experience guide sheets stem from experiences of the writer as a teacher of general science and biology and as a student in a summer conservation laboratory. A definite arrangement has been used in the construction of the guide sheets.

The values of field experiences are based on learning by actual doing and observing by students. Selected biological principles which may be related to the field experience are a part of each guide sheet. The application of these principles in a real live experience should become more functional to the student than does the application of principles from secondary sources.

The report has been organized in the following arrangement:

Chapter I: Statement of Problem.

Chapter II: A Selected Group of Related Source Teaching Materials for Science Teachers. This chapter includes a brief digest of eight recent publications of aids to enrich high school science classes.

Chapter III: The Place of Field Experiences. This chapter presents the argument for the need of field experiences as a part of the total learning process of students.

Preparation and planning for field experiences are also a part of this chapter.

Chapter IV: The Construction of the Guide Sheets. This chapter presents the methods and procedure that are used in the design and contents of each field experience guide sheet.

Chapter V: Fifteen Field Experience Guide Sheets.

Chapter VI: List of Related Field Experiences.

Bibliography.

CHAPTER II

A SELECTED GROUP OF RELATED SOURCE MATERIALS FOR SCIENCE TEACHERS

Materials in the form of hand books, suggested projects and demonstrations and recommendations to enrich the existing science courses are continually produced and are available to the alert high school science teacher. A selected group of such materials have been examined by the writer and in many cases use has been made of the material in his science classes. Materials of this nature include:

Tested Demonstrations in General Chemistry.[1]

A series of twelve demonstrations compiled by Hubert N. Alyea of Princeton University. Instructions, materials, and added footnotes designed to help the teacher in organizing his demonstration material in a minimum of time. A new demonstration appears in each publication of the Journal of Chemical Education.

High School Chemistry, Keeping the Course Up to Date.[2]

The report of thirty-six chemistry teachers in 1956 Summer Conference for Wisconsin High School Chemistry Teachers. The report consisted of three parts, the first and second considered the problems of the teacher in keeping up to date with the advance of chemical knowledge and methods of teaching. The third, considered problems associated with making the laboratory and laboratory type activities effective in teaching of high school chemistry.

Simple Demonstrations in Physics with Inexpensive Equipment.[3]

Dr. Sutton has contributed ninety one experiments and demonstrations from his long experience as a physics teacher and student. These experiments are simple yet unusual, using inexpensive material. Every high school physics and general science teacher should find these experiments a valuable asset to his

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[1] Journal of Chemical Education, Tested Demonstrations in General Chemistry. (Undated), 26 pages.

[2] "High School Chemistry Keeping the Course Up to Date", The Science Teacher, Vol. XXIII No. 8. December 1956. pp. 401-416.

[3] Richard M. Sutton, Simple Demonstrations in Physics with Inexpensive Equipment, Haverford College, Haverford, Pa. 1955. 14 pages.

classes. The ninety-one experiments are divided into the following divisions: mechanics, mechanics of fluids, sound, heat, electricity, light, and atomic and nuclear physics.

The ninty-one experiments invite one to use imagination and turn common materials at hand to one's use, employing them often in unconventional ways.

Conservation Handbook.[4]

This book was designed to help teachers get started on teaching of conservation. It is a handbook and contains outstanding examples of good conservation teaching in the United States. Many examples and illustrations of successful methods and techniques available have been included in the handbook.

Munzer and Brandwein,[5] have compiled a handbook on conservation for science teachers grades one through twelve.

The first section of the book contained information on scope and sequence for conservation education and the integration of conservation into the existing courses of science. The second into (A) Conservation, as a study of interrelationships between living things and their environment, (B) Conservation, as a study of interrelationships between matter and energy, (C) Conservation as a study of human resources.

The book has been cross-indexed according to subject areas for convenient use by teachers of general science, biology, chemistry, and physics. Hundreds of projects, demonstrations and experiments have been included in the book.

New Ideas for School Science Laboratory Activities.[6]

A report of the 1954 West Coast Science Teachers Conference have made eighteen recommendations to science teachers relating to school laboratory activities. The report also included twenty-seven suggested laboratory activities for high school science classes.

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[4] Handbook for Teaching of Conservation and Resource Use. The National Conservation Committee of the National Association of Biology Teachers. The Interstate Printers and Publishers, Inc. Danville, Illinois, 1955 499 pages.

[5] Munzer, Martha and Paul F. Brandwein - Practical Suggestions for Teaching Conservation, The Conservation Foundation, Joint Council of Economic Education, (Unpublished).

[6] "New Ideas for School Science Laboratory Activities." A report of 1954 West Coast Science Teachers Summer Conference, Oregon State College, The Science Teacher, Vol. XXII, February 1955, pp. 25-40.

Science Related Mathematical Exercises.[7]

Fifteen recommendations to science teachers were made in the report. The purpose of the recommendations was to help teachers keep more capable students on their way toward scientific, engineering and technical careers. Some sixty-four different exercises which combine mathematical skills and science "know how" were also in the report. This type of exercise seems to parallel most closely the work of practicing scientists, engineers, and mathematicians.

Science Projects as Stepping Stones to Careers in Science.[8]

Eight recommendations to the science teachers were made to nurture scientific curosity in youth, particularly those youth in grades nine through twelve. Suggestions to teachers were made on the following problems regarding student projects. They were:

Why do projects?
Which students can do projects?
When should projects be done?
Where should projects be done?
Motivation and limitations.
Evaluation.
Reporting of projects.
Helps (references on projects).

Included in the report were thirty-two ideas for student projects. Procedures were described for each of the thirty-two suggested students projects. Many also contained references for further pursuit of a project.

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7 "Science Related Mathematical Exercises". Prepared by the 1955 West Coast Science Teachers Summer Conference, San Jose State College, The Science Teacher, Vol. XXIII, Feb. 1956, pp. 29-44.

8 "Science Projects as Stepping Stones to Careers in Science". A report by 1956 West Coast Science Teachers Summer Conference, Oregon State College. The Science Teacher, Vol. XXIII, Nov. 1956, pp. 337-352.

CHAPTER III

THE PLACE OF FIELD EXPERIENCES

By the nature of some science courses, biology in particular, field experiences are probably more closely associated with science courses than with any other in high school. There are ample opportunities for field experiences to help make science more functional to the student, to help him understand and solve problems that arise in the study of science. In order that the student may have a real learning situation, many living things, both plant and animal should be studied and observed in their natural environment.

All schools have some facilities and areas that may be used in observing and studying natural phenomena as related to biological problems. The areas may range from the school yards to state and national parks. Several problems arise however, when the areas are utilized and field experiences are undertaken. Some of the problems encountered are: the attitude and extent of cooperation of the school administration; the time element involved, that is, how long will the field experience take and how will it affect the school program; cost of pupil and to school; transportation; pupil permission; weather; and safety.

In answer to the problems involved in field experiences, it seems that the teacher must justify each field experience in terms of experience and knowledge gained by the students. The teacher must be convinced that the educational value of the field experience outweighs the difficulty of the problems involved and should be able to justify the position to the school authorities.

Some factors in the planning and executing of successful field work were given by Dexter.[9] They were:

1. Familiarity with region.
2. Organization of trip.
3. Objectives.
4. Attitudes.
5. Viewpoint of ecological interpretation.

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[9] R. W. Dexter, "Field Study -- The Backbone of Biology and Conservation Education", School Science and Math, Vol. 43, pp 509-516,(June 1943).

6. Collecting (judicious).
7. Projects.
8. Training and experiences for teachers in how to conduct field trips such as, conservation camps and laboratories.

Field experiences should be carefully planned and carried out under teacher supervision and guidance in order that this teaching aid be meaningful and valuable in presenting and solving problems under consideration.

> "Field trips are experiences that make the greatest impressions and are remembered longer than most other school experiences. Such activities are worth every effort, whether they are arranged on school time or must be planned as extra-curricular work".[10]

The guide sheets that accompany this report offer suggestions for planning a field experience regarding the place to go and the activities that may be utilized during the experience. Preplanning by a teacher for an out-of-doors classroom experience includes important parts that are not included in the guide sheets. Some important preplanning steps for the teacher to make include:

1. Arrangement with and consent of property owner at which field experience is to take place.
2. Pre-visit to site by the teacher.
3. Class preparation for the trip.
   (a) Discussion of field experience using guide sheets.
   (b) Clothing, equipment, and food.
   (c) Rules of the Day.
4. Transportation arrangements.
5. Permission of principals and of parents.
6. Follow up sessions for evaluation of field experience.

Examples of field experiences and field experience techniques by experienced teachers were given in the Conservation Handbook.[11] In the examples, the field trips were taken by biology classes. In the report by Mr. Lorenzo Lisonbee of North Phoenix High School the procedure used included:

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[10] Conservation Handbook, op. cit., p. 358.

[11] Ibid. p. 362-393.

1. Determining student interest.
2. Determing the availability of resource officials to act as guide lecturers.
3. Determining transportation facilities.
4. Obtaining school approval.
5. Planning the details with students.
6. Planning the details with resource guide-lecturers.
7. Arranging other details.

Mr. Edward G. Damon of Alamogordo New Mexico High School reported a similar procedure that was used in field trips. They were:

1. Purposes of the field trips.
2. Problems involved in taking the trips.
3. Selection of the sites for the trips.
4. General Preparation for the trips.
5. The actual trip.
   a. Procedure
   b. Questions
   c. Results
6. Summary.

A pamphlet[12] by Paul DeH. Hurd of Stanford University contains a comprehensive survey of field trip techniques. The contents of the pamphlet should serve as a guide to the teacher who feels the need of developing field trip techniques.

The arrangement of the pamphlet used headings in the form of questions. A discussion followed each question and served to answer the question asked in each of the headings. The questions in the pamphlet were:

1. What is a field trip?
2. Why are field trips important?
3. When should we take a trip?
4. How are field trips organized?
5. Why is a field trip study guide important?
6. How is a resource center chosen?
7. Who is to guide?
8. How do we make final arrangements for the trip?
9. What about finances?
10. How about all the details?
11. Will I be held liable for accidents?
12. What do we do on the way?
13. ... And now that we have arrived?
14. What happens when we get back to class?
15. Is it important to evaluate the field trip?
16. How can we develop a field trip resource guide?
17. But we have no place to go ...!
18. How can the administrator help?
19. How can business and industry help teachers to develop good field trips?

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[12] Paul DeH. Hurd, "Let's Take a Field Trip". National Science Teachers Association, Pamphlet No. 1, 1956, 12 pages.

A selected list of films and filmstrips useful for pre-service and in-service teacher education programs is also a part of the pamphlet.

The Webster Groves Missouri Schools use the following form for permission from parents for students to take school bus trips. This form is submitted to serve as a guide for teachers to use in developing field experiences in their schools.

Student's Name _____ Grade _____ Homeroom Teacher _____

SCHOOL DISTRICT OF WEBSTER GROVES
Webster Groves, Missouri

PERMISSION FOR SCHOOL BUS TRIPS
(For the School Year 1956-1957)

Dear Mr. and Mrs. _____:

If you are willing for _____ to go on trips on the school bus with a class, an activity group, or a team, - and under the direction of the teacher, teacher-sponsor, or coach, -- please sign this slip and return it prior to the student's first trip by bus.

Every endeavor will be made to insure safety, but the child goes on your responsibility.

Date _____ _____
Signature of Parent or Guardian

The following form is used by the Webster Groves Missouri Schools showing the use of the School Bus by High School organizations.

(Please file in your notebook for reference) September 1956

Use of the School Bus
By High School Organizations

In addition to the attached sheet of information entitled "Regulations Governing the Use of School Bus", there are some specifics concerning the use of the bus by high school groups.

PERMISSION OF PARENTS

Each student must have the written consent of his parents before riding on the bus. (A sample of mimeographed form for filing this consent is attached.)

We will ask for the written consent but once during the school year. The one signed statement may serve for several trips by one organization or for different organizations.

As the slips (Permission For School Bus Trips) are returned by the student, they will be placed on file in the High School Office by the sponsor or teacher of the respective group.

A few days prior to a trip, the coach, sponsor or teacher in charge should check the office file to see that each student who is to ride on the school bus has a permission slip on file.

No student should be permitted to ride on the school bus who has failed to RETURN A WRITTEN STATEMENT OF CONSENT.

Coaches, sponsors and teachers who have groups that are likely to make trips on the school bus, may file the consent slips early in the school year if they wish, but prior to a given trip, we must be certain that we have the parent's consent for each student.

BUS RESERVATIONS

Use of the school bus should be checked with Mr. Latta prior to making reservations at the Superintendent's Office. Reservations in the metropolitan area will have priority over local trips such as those to Memorial Park. Since there is only one bus to serve the entire district, no one organization should expect to bloc out a series of dates in any one month.

CAPACITY OF THE BUS (31 students and a sponsor)

You will note under regulation number seven (7), on the attached sheet, that there is not to be an overloading of the bus. It's capacity is 32 people. This means that not more than 31 students and a teacher should be assigned to the bus. For the sake of safety, emphasis is being placed on no overloading.

School regulations governing the use of the school bus and school bus trips that are used by the Webster Groves Missouri Schools are stated as follows:

(Please keep for reference) September 1956

REGULATIONS GOVERNING THE USE OF SCHOOL BUS

1. The bus will be available to any and all school groups, under the direct leadership of a teacher, for educational trips. This will include trips growing out of interests developed in extra-curricular groups as well as classrooms. The bus will not be available for social occasions. Each group should plan for all trips so that real educational values may be derived.
2. Written parental consent must be had before children are transported. This permission must absolve the school from responsibility in case of accident. The slips giving parental consent shall be filed in the office of the building principal.
3. The bus will be available beginning at 8:30 a.m., on school days and by arrangement at other times. On days when both morning and afternoon trips are being made, at least 45 minutes will be reserved for the driver at the noon hour.

4. Reservations for the use of the bus are to be made in requisition form by the teacher desiring to make the trip. This form should show the date the trip is planned, the place to be visited, the time of departure and return, and other pertinent information subject to the approval of the principal.

5. A teacher, actively in charge of the group must accompany the bus at all times when children are being transported. The driver will be specifically instructed not to move the bus without a teacher in charge.

6. The teacher in charge shall be responsible for the conduct of the children being transported. The sponsor is asked to sit in the back of the bus so he may be aware of the behavior of the group throughout the coach.

7. Overloading shall be avoided, and in no case shall chairs or equipment be placed in the aisle of the bus, nor shall children be allowed to stand in the aisle.

8. The use of the bus is restricted to the greater St. Louis area. This is, St. Louis County, St. Louis City and the immediate East Side.

9. The extension of any trip beyond the above limits must be by permission of the superintendent of schools.

10. The bus must be driven by a qualified person possessing a chauffeur's license.

11. Reservation for the use of the bus must be made at least 48 hours in advance of expected use.

CHAPTER IV

CONSTRUCTION OF FIELD EXPERIENCE GUIDE SHEETS

The field experiences of Chapter VI were designed primarily for use in high school biology courses. However, teachers of general science and teachers of elementary schools may fit them to their classes. Teachers that have or plan school camps may find the guide sheets of value in school camp programs.

These field experiences have been designed to be used by both teacher and student. The experiences have been designed as complete within themselves. Collections of materials for later classroom use is not necessarily a purpose of the experience. Miller and Blades[13] have published a book that contains excellent suggestions for procedures and techniques for collecting and preserving materials from field trips for later classroom use. The experiences on the other hand, were designed as only a part of a total scheme of learning. To be effective then, each experience should be integrated with other learning experiences of the student.

Each experience is described in the form of a guide sheet. The outline for the construction of each guide sheet follows:

1. Title.
2. Introduction and purpose.
3. Materials if any.
4. Sample questions for discussion and evaluation.
5. Some biological principles that may be related to the field experiences.

The title includes the name and in some instances the destination of the field experience.

The introduction and purpose is a statement in terms of what observations and learnings may be obtained from the field experience. Some experiences also include materials to be used during the trip. A description of procedures to follow in activities of the experience are a part of some guide sheets.

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[13] D. F. Miller and G. W. Blades, Method and Materials for Biological Sciences, New York; McGraw Hill Book Co., 1938 Chapter 12.

Sample questions are designed to give a student a further guide in getting the most information that he can from the experience. The questions may be used during the trip and afterward in group discussions. The questions may serve as a means for evaluating the students by utilizing some of the questions for testing purposes.

The biological principles that accompany each guide sheet have been taken from a group of three hundred major principles published by Martin.[14] He considered these three hundred principles important for the purpose of general education. In making the list of three hundred major biological principles, an analysis of ten selected textbooks was made to determine the generalizations which appeared in them. The generalizations secured in this analysis were combined with the biological generalizations which appeared in available reports of research studies on principles of science.

Perhaps biological principles other than those stated on the guide sheets may be related to the field experience. Conservation implications have been incorporated into the field experiences by design rather than by accident. Many of the biological principles and sample discussion questions relate to wise use of natural resources.

The guide sheets were developed from experiences as a teacher of biology and as a student in a summer conservation laboratory.

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[14] W. Edgar Martin, The Major Principles of the Biological Sciences of Importance for General Education, Washington D.C., U.S. Office of Education, 1948, 29 pp.

CHAPTER V

FIFTEEN FIELD EXPERIENCE GUIDE SHEETS

FIELD EXPERIENCE: No. 1 A FARM POND

Destination: A farm pond where pond animals and plants are well established.

Purpose: To learn the ecological relationships of water plants and animals. To become familiar with the names and habits of some of them. To obtain pond water to be examined under a microscope later in the classroom. To begin in the students mind a train of thought which can be directed to the study of the food chain.

Sample questions for discussion:

1. Why can certain green plants grow completely under water or partly submerged while others can not?
2. Do any water insects live completely under water? During any part of their life cycle?
3. Why is there usually more bird and animal life if there is a pond nearby?
4. Why don't water plants completely over-grow the pond and cause it to disappear?
5. Why is there usually about the same number of fish in the water?
6. What part do the microscopic plants and animals play in pond life?

Some biological principles which may relate to a farm pond are:

All living organisms have other living things which compete with them for the available energy.

The forms of all chlorophyll-bearing plants are adapted for carrying on photosynthesis.

In the presence of sunlight the chloroplasts of chlorophyll-bearing plants convert carbon dioxide and water, into intermediate substances, and these into sugar, and sugar into starch, and liberate oxygen; thus directly or indirectly producing practically all the food in the world.

A balance in nature is maintained through interrelationships of plants and animals with each other and with their physical environment.

FIELD EXPERIENCE: No. 2 FISH HATCHERY

Destination: Local conservation commission fish hatchery.

Purpose: To learn a part of what the conservation commission is doing to increase and control fish in local rivers and lakes and to learn something of the life habits of game fish, their food, habits and mode of reproduction.

Sample questions for discussion:

1. Does artificial stocking of ponds and rivers always solve the game fish problem?
2. What other factors are important in determining what fish will live in certain body of water?
3. Are there any disadvantages to raising fish in this way for these purposes?
4. In what way does the land around the water influence the fish which grow there?
5. Do fishing limits and laws really effect fish population? Why?

Some biological principles which may be related to the field experience at the fish hatchery are:

> Water is essential to all living things because protoplasmic activity is dependent upon an adequate water supply.
>
> When new species are introduced into a country, few individuals or species will find themselves in the same balance as in their old home. For the majority, conditions will be unfavorable; they will fail to gain a footing and some will disappear. If the introduced species chances to be better suited, especially if it is removed from its old enemies and parasites, its numbers will increase often far beyond anything possible to it in its native country; not infrequently its abundant will force it into changed habits.
>
> Every living species is continually producing a multitude of individuals, many more than can survive, varying more or less among themselves, and competing against each other for the available energy.

FIELD EXPERIENCE: No. 3 BALANCED FARM

Destination: A balanced farm or farms. (Farms working with the State Farm Extension Service or with the Soil Conservation Service).

Purpose: To observe the results of practicing soil conservation on the farm. To learn as much as possible about the agencies helping farmers practice conservation. To see the instruments of conservation as crop rotation, farm woodlots, contour plantings, farm ponds, purebred livestock, fertilization, fence row cover for wildlife, multiflora rose fences, etc.

Sample Questions for Discussion:

1. Why is crop rotation beneficial?
2. What are some advantages of a farm pond?
3. Why should a farm woodlot not be pastured?
4. Is the financial gain from a farm woodlot enough to make it worth keeping up?
5. What products are possible from small trees and second grade lumber?
6. Why should some land never be cleared for cultivated farming?
7. What are the advantages of windbreaks?
8. Will there be more or fewer insects on crops if fence rows are left uncleared? Why?
9. Why would it be to the farmer's advantage to encourage game on his farm?
10. Discuss advantages and disadvantages of multiflora rose for fences.

Some biological principles which may be related to the field trip to a balanced farm are:

There is a cycle, from inorganic substance in the air and soil to plant tissue, thence to animal tissue, from either to the last two stages via excretion or death and decay back to the air and soil. The energy for this everlasting rotation of life is furnished by the radiant energy of the sun.

An organism must have certain materials for its life processes and each organism must secure the required materials that it cannot build for itself.

The work of the chlorophyll of all chlorophyll-bearing plants is essential to all living things.

The forms of all chlorophyll-bearing plants are adapted for carrying on photosynthesis.

All living things respond to stimuli in their environment.

Every species of organism is subject to certain checks or controls in the form of enemies and only those members that are most capable of avoiding their enemies survive to reproduce new off-spring and thereby transmit many of their characters to their offspring.

The environment of living things changes continually.

Water is essential to all living things because protoplasmic activity is dependent upon an adequate water supply.

In general, the natural flora and fauna of a region is the most luxuriant that it can support.

FIELD EXPERIENCE: No. 4 FEED MILL

Destination: A Feed Milling Company.

Purpose: To see the process of feed production. To learn what different feed rations are composed of. To learn why the rations of different animals also differs.

Sample Questions for Discusstion:

1. What are some of the testing programs carried on by the milling company?
2. How does balanced ration affect growth of cattle and other farm animals? Cost of production?
3. How is balanced rationing a type of conservation?

Some biological principles which may be related to the field experience of observing a feed mill in operation are:

> There is a cycle, from inorganic substances in the air and soil to plant tissue, thence to animal tissue, from either of the last two stanges via exretion or death and decay back to the air and soil. The energy for this everlasting rotation of life is furnished by the radiant energy of the sun.
>
> In the presence of sunlight the chloroplasts of chlorophyll-bearing plants convert carbon dioxide and water into intermediate substances, and these into sugar, and sugar into starch, and liberate oxygen; thus directly or indirectly producing practically all of the food in the world.
>
> All the energy used by chlorophyll-bearing plants in their secondary building processes comes from compounds formed in photosynthesis.
>
> An animal cannot live without proteins. They are necessary in cell growth and maintenance; so are necessities in the diets of animals. Plants are able to use carbohydrates and nitrates to build up the proteins necessary for growth and maintanence of their cells.
>
> Life as we know it, is dependent upon complex chemical compounds of carbon, nitrogen, hydrogen, oxygen, and other elements.

FIELD EXPERIENCE NO. 5: ORCHARD

Destination: A local fruit orchard.

Purpose: To observe the methods and results of insect and fungus control, to observe the use by orchardists of bees for pollination.

Sample Questions for Discussion:

1. Why is a spray an effective way to use an insecticide or a fungicide?
2. What chemicals are used in the spray?
3. What insects are affected by them?
4. How often is it necessary to spray an orchard?
5. Why are bees essential for fruit production? Do any other plants depend on bees in this way?
6. Why are apple trees pruned so vigorously? How is this a kind of conservation?
7. What relation does spraying orchards have to conservation?

One biological principle which may be related to the field trip to an orchard is:

> A parasitic organism harms its host in various ways and to various degrees, by actively attacking the tissues, by shedding poisons, which are distributed throughout the body of the host, by competing with the host for food, or even by making reproduction of the host impossible.

FIELD EXPERIENCE NO. 6: PEST CONTROL

Destination: A town sprayed with DDT for fly elimination.

Purpose: To observe the results of such a program, to discover any disadvantages, to see how effective was the program.

Sample Questions for Discussion:

1. Do there seem to be fewer flies than before the spraying?
2. Are there fewer other insects?
3. Were bees effected by the spray?
4. Could the surrounding countryside supply enough flies to repopulate the town after the effects of the spray lessen?
5. Considering the cost of the program, were the results worthwhile?

Some biological principles which may be related to the field experience of pest control are:

The environment of living things changes continually.

The species not fitted to the conditions about them do not thrive and finally become extinct.

FIELD EXPERIENCES: NO. 7: SOIL LIFE EXAMINATION

Introduction and Purpose: This is a project that will probably open the eyes of all who take part. The myriad of living things that live in and affect the soil is gigantic in number. No longer will soil be a lifeless object. The purpose is to gain an understanding of the number of living things in the soil.

Materials: Old newspapers or wrapping paper, pieces of screen about one foot square, tweezers, several small bottles of alcohol. Two areas of soil, one with heavy leaf litter and humus and one with light leaf litter and humus.

Method: Dig up about one square foot of soil approximately six inches deep from each section. Place on newspaper and catch as many escaping insects in separate bottles for each plot.

Sift the soil, a handful at a time through the screen placing as many of the insects as can be captured in bottles. Do this with both samples keeping them in separated containers. The insects can be counted at this time as they are put into the bottles. After insects count is made multiply the number by 43,560 square feet and the resulting figure is an approximation of the insects in an acre of this kind of top soil.

Sample Questions for Discussion:

1. Are there any differences between the deep litter and the shallow litter areas? If so, how do you account for the difference?
2. In what ways is this animal life important to us?
3. How did the number of specimens compare with your estimate? How do you account for the difference?

Some biological principles which could be related to the field experience of making a soil life examination are:

> The existence of organisms depends upon their interrelations with the environment which include both the inorganic world and other organisms.
>
> A balance in nature is maintained through interrelationships of plants and animals with each other and with their physical environment.
>
> Only the topsoil, with its rich organic matter, its porous structure, and its living organisms, can hold the water, and provide the minerals necessary to the life of most plants.

FIELD EXPERIENCE: NO. 8 and 9: MAKING A SOIL PROFILE AND TESTING THE SOIL

Introduction and Purpose: As an added aid in completing an ecological survey or as an independent field experience, the students can be shown how to read a soil profile and test the soil for acidity or alkalinity. These demonstrations or projects are of practical use in the practice of conservation and the understanding of its meaning. The purpose of this field experience is to gain an understanding of different layers which the soil contains and relative thinness of the top soil.

Materials: Shovel.

Making a soil profile:

Method: After choosing several places of widely different soil surfaces as forest covered, cultivated, grassy, level and sloping, excavate a small hole in each leaving one straight visible side. Observe the layers of soil in each profile.

Sample Questions for Discussion:

1. How many soil layers are there in each? Compare depths of each layer.
2. Which location has the deepest top soil? Why?
3. What are the other layers or horizons and why are they important?
4. Are there three horizons in each instance? If not, which is lacking, top soil, subsoil, or parent material?
5. Explain in each case why the profile is as it is?

Testing Soil for Degree of Acidity:

Materials: Inexpensive soil testing kit.

Introduction and Purpose: The soil acidity is an important factor in determining the kind of plants that will grow on a soil. The purpose of this field experience is to gain elementary skill in soil testing and to gain an understanding of the differences of acid content in different soils, and its effect on plant distribution.

Method: Follow directions on kit testing soils in many different locations as available or practical.

Sample Questions for Discussion:

1. Why are some soils more acid than others?
2. Are plants limited in any way in their ability to tolerate acid?
3. How do you explain why the plants found on the test areas are growing there?
4. What relation can you see between these facts and modern farming practices?

Some biological principles which may be related to the field experience of making a soil profile and testing the soil are:

Plants and animals are directly or indirectly dependent on the soil.

All plant and animal life, along with the climate and varying weather, play an active part in helping to form and to change the soil.

Parent material for the development of soils is formed through the physical disintegration and chemical decomposition of rock particles and organic matter.

Only the topsoil, with its rich organic matter, its porous structure, and its living organisms, can hold water, and provide the minerals necessary to the life of most plants.

FIELD EXPERIENCE NO. 10: AN ECOLOGICAL SURVEY OF PLANTS ON A GIVEN AREA[15]

Introduction and Purpose: An ecological survey has to do with living organisms in relation to their environment. Is there any correlation between the distribution of plant species and the type of soil, slope, and exposure? This project is designed to give the student the understanding that our land does vary and so should be handled as people with varying personalities should be handled. All men cannot be millionaires, so all land cannot be deep, rich, and productive. By studying a small area with its micro-climates or local differences, comparisons, with larger areas are possible.

Materials: A plot of ground preferable with some sloping parts, some wooded areas not too influenced by man. A farm woods that hasn't been pastured could be suitable. The size of the plot will depend on number of individuals and the time allowed for the project.

Method: Mark the boundaries of the plot using stakes and string. Prepare an outline map of your plot on paper using a suitable scale. Fill in the map with data gathered from observation. Plot the approximate location of each tree over two inches in diameter using colored pencils or identifying signs for each species. (Identification of tree to be made with Instructors help).

If the plot is larger than 25' x 25', subdivisions could be marked off by strings and each division studied as a unit. Plotting may be done in the field on note paper then transferred to the map when a table and drawing equipment are available. Make notes of what tree species dominate the area or subdivision; what species appear to be reproducing; note any correlation between the tree species and the type of soil, moisture, slope and exposure. List the shrubs and vines that dominate the area if any. Note any correlation between their distribution and the type of soil, moisture, geological formation, slope, and exposure. Has man utilized the area? Has this had any effect on present day vegetation?

Using this data fill in the map and write an accompanying report including the above relationships and information.

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[15] Notes from Ed. 682 Conservation Laboratory Ohio State Univ. 1948, Clyde H. Jones, Instructor.

Sample Questions for Discussion:

1. If you were asked to produce a maximum of economically important forest products on this plot how would you proceed?
2. Do the plants growing there now give you any hint as to what would grow there?
3. Suppose economic conditions forced you to convert the area into pasture or cultivated land, how would you proceed in each case? What would you plant?

This same type of survey could be made of animal life either at the same time on the same area or a future time. Traps could be set at intervals and small animals counted. Birds and larger animals (squirrel, rabbits, etc.) could be counted by observation. The same relationships between life and environment could be noted.

This type of survey may be better worked out by a group and over a longer period of time.

Sample Questions for Discussion:

1. Is the amount of animal life abundant or scarce? How do you account for the number present or absent in the area?
2. Trace the food chain up to a larger animal in the area.

Some biological principles which may be related to the ecological survey are:

Living things are not distributed uniformly or at random over the surfaces of the earth, but are found in definite zones and local regions where conditions are favorable to their survival.

Each species of animal or plant tends to extend its range until some impossible barrier is encountered.

The numbers of any species depend, on the one hand, upon its rate of reproduction and growth, and on the other, upon its death rate from accident, enemies, and disease.

The existence of organisms depends upon their interrelations with the environment which includes both the inorganic world and other organisms.

A balance in nature is maintained through interrelationships of plants and animals with each other and with their physical environment.

Each species of living organism is adapted, or is in the process of becoming adapted, to live where it is found.

All living things are continually engaged in an exacting struggle with their environments.

FIELD EXPERIENCE NO. 11: HOW TO MAKE A CONTOUR LINE

Destination: An Unlevel area.

Introduction and Purpose: Seeing, it is said, is believing. Terms such as sheet erosion, gully erosion, contour planting are just words to many high school science students, just vague ideas to others. Though they may have seen these very conditions, they saw only with their eyes and without a guide or any explanation, missed the tragic meaning of such areas. A field trip with such a mind opening purpose can be the start of a conservation conscience class.

Material: Vivid examples of sheet and gully erosion; examples of countour plowing; a surveying transit and a sight pole; a supply of short stakes; a slope suitable for taking a contour line.

Method: One person stand at base of slope and use transit, sighting toward second person holding a marker. Keeping the transit level and at the same height find several places across the slope where the marker is visible through the transit. Place stakes at these points. A string tied connecting these stakes marks a contour line. For the next contour line, move the transit up to the first contour and proceed as before.

Sample Questions for Discussion:

1. Explain the meaning of gullying and sheet erosion.
2. Why do some areas seem unaffected by erosion?
3. What factors determine the amount of erosion?
4. Make a list of the advantages of contour farming; Disadvantages.
5. What is the difference between strip and contour planting?
6. Can strip planting by itself ever do more harm than good?
7. What are the advantages of using stripping and contouring together?
8. What is a grass waterway and when is it used?

Some biological principles which may be related to the field experience of making contour lines are:

> All plant and animal life, along with the climate and varying weather, play an active part in helping to form and to change the soil.
>
> Only the top soil, with its rich organic matter, its porous structure, and its living organisms, can hold the water and provide the minerals necessary to the life of most plants.

FIELD EXPERIENCE NO. 12: DETERMINING SLOPE

Destination: An unlevel area, (school yard, or nearby field).

Introduction and Purpose: The purpose of this experience is to observe the effects of slope on factors important to plant growth.

Materials: A slope board made by using a large size protractor with a weighted cord from the center. A marker of equal height to the slope board when slope board is placed at eye level.

Method: Sight to marker and read the number of degrees between the weighted cord and 90°. This figure is the angle of slope between the observer with slope board and the marker.

Sample questions for Discussion:

1. What effect does slope have on the soil? Vegetation? Light? Ground moisture?
2. How could effect of slope be changed without changing the slope itself? (See contour farming, terracing, etc.)

Some biological principles which may be related to the field experience of determing the degree of slope are:

> Living things are not distributed uniformly or at random over the surfaces of the earth, but are found in definite zones and local regions where conditions are favorable to their survival.
>
> Each species of animal or plant tends to extend its range until some impossible barrier is encountered.

FIELD EXPERIENCE NO. 13: STATE FOREST

Destination: State Forest.

Purpose: To observe a Forest Ranger at work, to see a fire tower and learn how it is operated, to see the results of forest replanting, to learn the importance of forest fire control, to prepare the student for a lesson in forest resources.

Sample Questions of Discussion:

1. Why doesn't plenty of forest land mean plenty of timber?
2. Does current forest growth equal current forest drain? Would it if fires were stopped?
3. Why worry if only a small percentage of our timber is cut annually?
4. What shortage of forest products are there today and why?
5. Who owns our forests?
6. Will tree planting solve the problem of lumber shortages? What about tree farms?
7. How are our private forest lands being handled?
8. What interest has labor in the forests been to farmers? To the average citizen?
9. How can all forest lands regardless of ownership be kept productive? Can they be made to supply all our requirements?
10. Would public forest regulations conflict with freedom of enterprise?

Some biological principles which may be related to the field experience of observing a state forest are:

> In general, the natural flora and fauna of a region is the most luxuriant that it can support.
>
> For most species of organisms the great checks on increase in numbers are enemies, disease and competition between individuals of the same species with another for food and other necessities of life.
>
> Plants and animals are directly or indirectly dependent on the soil.
>
> Every living species is continually producing a multitude of individuals, many more than can survive, varying more or less among themselves, and all competing against each other for the available energy.
>
> Species not fitted to the conditions about them do not thrive and finally become extinct.

FIELD EXPERIENCE NO. 14: FLOOD CONTROL DAMS

Destination: One or more of the flood control dams along the local river.

Purpose: To understand the workings and construction of a flood control dam. To see the effect of such a dam on surrounding area. To learn the relationship of one dam with another on the same river. To discuss the amount of actual benefit provided by these dams.

Sample Questions for Discussion:

1. Would you expect to find more or fewer fish in the dammed water than in the river below? The same kind of fish or different?
2. How long will the dam last? Is silt filling it up? Why? What could be done to prevent this?
3. Is the flood control benefit enough to compensate for the loss of land inundated?
4. Of what importance are the recreational aspects of the lake? Under who's control are they? Do you think this is best? If not what would you suggest?

Some biological principles which may be related to the field of experience of observing flood control dams are:

The environment acts upon living things, and living things act upon their environment.

A balance in nature is maintained through interrelationships of plants and animals with each other and with their physical environment.

When the balance of nature is disturbed, disastrous results often follow.

The environment of living things changes continually.

FIELD EXPERIENCE NO. 15: LEAD AND ZINC MINING AREAS

Destination: A local lead and zinc mining area and old mined out area. Areas in which there are coal strip mines or old abandoned oil fields may be utilized for this field experience.

Purpose: To observe the results of mining on the area to discover ways of reclaiming old mine areas from observing what has happened naturally to some areas.

Sample Questions for Discussion:

1. Who owns the old mined out areas?
2. Is it important that the land be made useful? Why?
3. Who should be responsible for its being made useful?
4. Suggest ways the land could be used?
5. To what practical use could the gravel and rock piles be put?
6. How would you return it to forest cover?
7. Are there fish in the mine openings that have become filled with water? Could fish be stocked here successfully?
8. What are the possibilities of making a park or recreational area?
9. Could the land ever be used for farming?
10. What could be done to the unfilled mine openings?

Some biological principles which could be related to the field experience on mining areas are:

> All plant and animal life, along with the climate and varying weather, play an active part in helping to form and to change the soil.
>
> The topsoil only, with its rich organic matter, its porous structure, and its living organisms, can hold the water and provide the minerals necessary to the life of most plants.
>
> The environment acts upon living things, and living things act upon environment.
>
> When the balance of nature is distribed, disastrous results often follow.

CHAPTER VI

A LIST OF RELATED FIELD EXPERIENCES

The location of the school may determine to a great extent the opportunities for observation and learning from field experiences.

A teacher would need to make a survey of the surrounding community in order to find the existing possibilities offered by the community for field experiences. A survey may include the following possibilities for field experiences.

1. Grade A Dairy and Milking Parlor.
2. Turkey Hatchery and Turkey Farm.
3. Food Processing Plants.
   (a) Milk Processing Plant.
   (b) Cannery.
   (c) Meat Packing.
   (d) Brewery
4. Biological Control Stations.
5. Wild-Life Refuges.
6. Large Metropolitan Zoo (Forrest Park Zoo)
   (a) Birds.
   (b) Primates
   (c) Reptiles
   (d) Mammals
   (e) Miscellaneous animal groups.
7. Botanical Gardens (Shaws Gardens St. Louis)
8. A Saw Mill
9. City Water Supply Plant.
10. City Sewage Disposal Plant.

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